

REMARKS

Interview with Examiner

A phone interview was held on May 7, 2009, between Examiner Campos and James C. Evans, Attorney for Applicant. At the meeting, the obviousness rejection of claim 1 was discussed. The Examiner and Applicant did not reach agreement on this topic.

Pending Claims:

Claims 1-5, 7, 9, 10, 13, and 16-24 are pending in this application as amended. Claims 6, 8, 11, 12, 14, and 15 were previously canceled. Claims 3 and 5 are original. Claims 1, 4, 20 and 23 are currently amended. The remaining pending claims were previously presented. Claims 7, 10, 13, and 16 were allowed.

Rejection: 35 U.S.C. §112

Claims 1-3, 9, and 17-24 were rejected as failing to comply with the written description requirement. Specifically, the Office Action (hereinafter, "OA") states that the Specification "does not provide support for the limitation of 'reporting respective new sizes of each of the at least one destination virtual disk before reporting a new storage size of the source virtual disk.' "

To overcome this rejection, independent claim 1 has been amended to read, in pertinent part, "increasing respective sizes of each of the at least one destination virtual disk before reporting a new storage size of the source virtual disk." This is supported by

the Specification (p. 12 lines 12-15; and p. 15 line 19-p. 16 line 2). Independent claim 20 has been amended correspondingly.

Claims 2, 3, 17-19, 21, and 22 depend on either claim 1 or 20, so the above amendment overcomes the rejection to these claims as well.

Applicant respectfully disagrees that the §112 rejection is relevant to independent claim 23, or to claims 9 and 24, which depend upon claim 23. In pertinent part, claim 23 states:

logic adapted to

provide reports of the size of the source virtual disk to the management module through the storage system interface,
satisfy an expansion request by creating an amount of necessary storage before changing the size that will be obtained by the management module in reports from the source virtual disk; and
changing the size that will be obtained by the management module in reports from the source virtual disk.

Unlike claims 1 and 20 (prior to the current amendment), claim 23 does not mention reporting sizes of destination virtual disks before reporting size of the source virtual disk.

Rejection under 35 U.S.C. §103(a)

Claims 1, 2, and 19

Claims 1-2, 9, and 19-24 were rejected as being obvious over Lubbers et al. (U.S. 6,880,052) in view of Bridge (U.S. 6,530,035). Applicant respectfully disagrees, and traverses this rejection for the following reasons.

Claim 1, prior to amendment, included (among others) the following steps:

reporting respective storage sizes of each destination virtual disk before reporting a new storage size of the source virtual disk; and reporting the new storage size of the source virtual disk.

As amended, the above steps read:

increasing respective storage sizes of each destination virtual disk before reporting a new storage size of the source virtual disk; and reporting the new storage size of the source virtual disk.

Applicant maintains that Lubbers and Bridge, alone or in combination, do not yield the above steps of Applicant's invention. The Examiner's arguments would appear to still apply to claim 1 after amendment. Relying on Lubbers, the Examiner argues:

After the size of the destination is configured and available to received data from source (thus reported available), the source is quiesced and no writes from host are received by the source, then the source and the destination are associated; the size of the source LUNs is available for writes from host (thus reported available) and the size of the destination LUNs is available for the source to copy data to the destination (col. 4, lines 44-67; col. 6, lines 6-37; col. 7, line 64-col. 8, line 29; col. 8, line 57-col. 9, line 8; col. 11, line 66-col. 12, line 12; col. 12, lines 38-51; figs. 4 and 6 and related text)

Applicant has carefully examined all 132 lines (!) cited above, as well as the figures, and has been unable to find where the sequence of steps relied upon by the Examiner is applied to "mirrored virtual disks" as specified by claim 1; in other words, where both the source disk and the destination (assuming, for example, that there is only) contain data at the start of the process; specifically, identical data. The only place

that Lubbers mentions *quiescing* the source disk pertains to adding a newly created virtual disk—that is, one that contains *no data*:

To establish a connection with the newly created destination virtual disk, the source disk is briefly quiesced in operation 613, during which time operational data traffic with hosts 102 may be cached. Once the connection is established and source and destination virtual disks are associated in operation 615, which might take only a matter of milliseconds, operational write transactions with the source LUN can be resumed in operation 617. Background copying of data proceeds in parallel in operation 619....

Col. 12 lines 38-48.

The above Lubbers language (which was cited by the Examiner in the rejection) is, therefore, irrelevant to Applicant's claim 1, both prior and subsequent to amendment. So what does Lubbers actually have to say about changing the sizes of virtual disks that are already mirroring each other?

When a LUN is replicated at multiple sites, a LUN is created at each site for implementing the replica. This set of LUNs is referred to as a "copy set" ... and the LUNs are referred to as members of the copy set. There are certain attributes, called dependent attributes that each member of a copy set must share, such as logical block capacity. There are other attributes, called independent attributes, that may vary among the members, such as RAID configuration. Virtualized storage allows the DRM [(data replication management)] system in accordance with the present

invention to ensure that when changes are made to a dependent attribute of one member of a copy set, the change is made automatically to each other member of the copy set. At the same time, virtualized storage allows the DRM system ... to implement changes to independent attributes at any time without affecting the other members of the copy set.

That virtual disk size is a dependent attribute follows from the statement that "once a LUN is increased in size, the increase can be propagated automatically to other members of a copy set involved in a DRM group." Col. 4 lines 51-54.

Now consider how Lubbers handles a copy set of three disks, a source disk S and two destination disks D1 and D2, that form a copy set. Suppose that the size of S were increased first. Also assume that S is not quiesced. Then it is possible that a host will write to S, using the increased capacity *before* the size increase propagates automatically to D1 and D2. This would break the mirroring, since Lubbers makes no provision for caching changes such intervening changes. It is interesting to note that this approach (which is inferior to that of Applicant's invention) will, nevertheless, give *correct* results in many cases, particularly if the storage system is rather lightly utilized.

Alternatively, suppose that the size of D1 is changed first. Now because Lubbers does not specify any sequencing rules in the copy set, D1 might propagate the size increase to S before D2. Again, the host will see the increased size of S, and again might write to the new storage added when the capacity was increased. In this case, D1 would be able to continue mirroring, but accurate mirroring to D2 would be broken.

Specific processes other than Applicant's do exist that Lubbers might be silently using, which would always give the correct result. For example, suppose that Lubbers first quiesces the *hosts*, possibly by sending them a message. Then the order in which sizes (say, of S, D1, and D2) are set and reported becomes irrelevant, so long as the hosts are reactivated after resizing all disks is complete.

In summary, Lubbers may either be (i) doing the resizing and reporting of the elements of a copy set in an order that works much, but not all, of the time; (ii) using an approach, which also works correctly, that is different from Applicant's; or (iii) using Applicant's approach. We simply *cannot tell* because Lubbers does not teach specifics of their approach. Simply citing a large number of lines from a reference cannot overcome the failure of that reference to teach an element of the claim!

The Bridge reference does not seem to Applicant to add anything to Lubbers in terms of the critical order-dependent steps in resizing a source and one or more destination disks in a mirroring relationship.

Thus, claim 1 as amended should be allowable, as should claims 2 and 19, which depend upon claim 1.

Claims 20-22

Claim 20 is an independent claim that was rejected based on Lubbers and Bridge using the same rationale that was used to reject claim 1. Claim 20 has been amended analogously to claim 1 (to overcome the §112 rejection), but otherwise should be allowable for the reasons argued above with respect to claim 1. Dependent claims 21 and 22 should therefore also be allowable.

Claims 23, 24, 9

Claims 23 and 24 use the phrases “adapted to,” “adapted for,” and “for” several times. In each case, the Examiner cites MPEP 2106 II-C as a basis for rejecting the claim. Regarding this language, the cited section of the MPEP states:

Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation.

The following are examples of language that may raise a question as to the limiting effect of the language in a claim: ... (B) “adapted to” or “adapted for” clauses.

Rather than mechanically flagging every use of such language for rejection, the above MPEP section requires an examination of whether the clauses in question have a limiting effect on the claim. Suppose, for example, we simply drop the relevant clauses from claim 23—do we wind up with an equivalent claim? The result is:

23'. An apparatus, comprising:

a set of mirrored virtual disks, including a source virtual disk and at least one destination virtual disk, the at least one destination virtual disk mirroring the source virtual disk, wherein the source and destination virtual disks have the same size;

a management module that includes

a host side interface, and

a storage system interface; and

logic.

That clearly is not what Applicant intended, or what the claim means in plain English.

Although the Examiner clearly has some discretion in rejecting claims under MPEP 2106 II-C, does that discretion have any limit whatsoever? Can an Examiner routinely reject every claim that has an instance of use of “for” or “adapted to”? Without any explanation in the OA to justify the rejection? The KSR and *Festo* decisions suggest that the Supreme Court does not favor rigid rules for interpreting patent claims.

Applicant contends that, in each and every case within claims 23 and 24, the flagged language does indeed limit the claim. For example, the apparatus comprises (1) “a management module that includes … a storage system interface *for* communicating with the virtual disks that is *adapted to* … obtain reports of the size of the virtual disks from the source virtual disk.” Both the “for” and the “adapted to” were flagged as “interpreted as intended use.” The apparatus also comprises (2) “logic *adapted to* … satisfy an expansion request by creating an amount of necessary storage before changing the size that will be obtained by the management module in reports from the source virtual disk.” Again, “adapted to” was flagged as “interpreted as intended use.” Note that clause (2) specifically refers back to the “reports” from clause (1). With that kind of interrelationship among the elements, how can there not be limitation?

In some situations, there is no better way to express a limitation on structure than to say what a component is “adapted to” or “for.” Computer logic (in hardware or software) is structure that is *adapted to* perform certain tasks. It does not actually perform those tasks unless commanded to do so. Capability to perform, and actually performing, an action is what distinguishes a process (e.g.,

claim 1) from an apparatus (e.g., claim 23). Applicant, therefore, respectfully requests that the Examiner reconsider what MPEP 2106 II-C expects in terms of a fair examination of claims 23 and 24. (Claim 23 has, in fact, been amended, but only to fix a verb tense disagreement.)

Claim 23 provides a specific sequence, analogous to claim 1, for expansion of a mirrored pair of disks that is found nowhere in Lubbers or Bridge. Thus, the language cited by the Examiner in rejecting this claim is inapposite. Claim 23, and dependent claims 24 and 9 should be allowed.

Claims 3, 17, and 18

Claims 3, 17, and 18 were rejected as being obvious over Lubbers in view of Bridge and Cabrera et al. (U.S. 6,629,202). Cabrera is offered as providing an operating system. But claims 3, 17, and 18 depend upon claim 1. Since Cabrera does not teach the sequence found in Applicant's claim 1 for increasing the size of a set of mirrored virtual disks, claims 3, 17, and 18 should be allowed.

Other Allowable Material

Grounds for rejection of claims 4 and 5 were not provided in the OA, so those claims should have been allowed. The following step in claim 4,

resizing the mirrored virtual disks reporting respective new sizes of each
of the at least one destination virtual disk before reporting a new
storage size of the source virtual disk;

has been amended to read,

resizing the at least one destination virtual disk before reporting a new
storage size of the source virtual disk;

Please note that the amended claim 4 should not be subject to the §112 rejection. Also, the arguments presented above regarding the relevance of the Lubbers and Bridge prior art also apply to claim 4. Therefore, claim 4, and dependent claim 5, should be allowable.

CONCLUSION

The amendments herein are supported by the specification. All of the claims remaining in this application should now be seen to be in condition for allowance. The prompt issuance of a notice to that effect is solicited.

Respectfully submitted,
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By its attorneys:

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